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ABSTRACT

A model for analyzing policy impacts is presented that will assist state-level policy makers in education. The model comprises four stages: (1) monitoring, which includes the identification of relevant trends and issues and the development of a data base; (2) forecasting, which uses quantitative and qualitative techniques developed in futures research; (3) goal setting by policy makers, which evolves from the forecasts in stage two; and (4) policy analysis and implementation, which encompasses the analysis of alternative policies' impacts on the trends, events, and goals chosen. An example is provided of how the policy impact model could be applied to school facilities planning in northwestern Louisiana, where future economic growth seems imminent. The monitoring stage of the model would entail identifying the relevant variables, such as population and enrollment trends, and the sources of data on these variables. In the forecasting stage, planners would choose the proper quantitative technique and check its results against those generated by qualitative forecasts. Goal setting would involve assisting local policy makers to choose normative goals and preferable futures. In the last stage, planners would identify potential school facility policies based on the goals and match them with likely impacts. (RW)

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DEVELOPING PUBLIC EDUCATION POLICY THROUGH POLICY-IMPACT ANALYSIS

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DEVELOPING PUBLIC EDUCATION POLICY THROUGH
POLICY-IMPACT ANALYSIS

The decade of the 80's promises to be one of change and uncertainty. Shifting demographics, changing enrollment patterns, changing programmatic demands and fiscal constraints will be the norm. It will be imperative that state education agencies use sophisticated analytical and organizational techniques in developing policy concepts and recommendations. Successfully enhancing the policy development process will be most readily accomplished when disaffection within the various power loci are minimized.

This paper presents a model for developing and assessing policies at the state-level consistent with the fiscal realities of the 1980's and the formal and informal power structures in education. This model, the policy-impact analysis model, provides a framework within which a variety of "futures" research, simulation and modeling techniques are integrated. The utility of the model is that it structures communication between those developing information about the future and those formally and informally responsible for policy formulation and decision-making.

There are a number of forecasting, simulation and modeling techniques that could be used by state education agencies in transforming extant data into policy concepts and recommendations. These techniques allow the user to predict future resource requirements and demands and to simulate the impact of current decisions or probable events on future resource requirements. It is suggested here that when in use, these techniques be imbedded within a consensus building process such as that suggested by W. L. Renfro in "Forecasting the Impact of Public Policies" (Long-Range Planning, 1980, 13 August, 80-89). In the suggested process: likely trends in education are identified; possible impacting events that could alter trends are identified; available resources and programmatic demand estimated given the various trend lines and impacts; and institutional configurations consistent with expected resources and predicted programmatic demand generated for the various possible futures. Trend analysis, systems modeling, delphi and Monte Carlo techniques are incorporated as aids in use of a policy-impact analysis process. The key to this particular process is the inclusion of participants from all the concerned power loci in the identification of likely events and in reviewing results.

Using policy-impact analysis the state education agency can engender a better understanding of approaching decision points and highlight the need for cooperation within the education community given the inexorable push of external events. At issue is whether the education community can focus analytical and organizational strength in creating its future or will default to others.

The Policy-Impact Analysis Model

There are four stages in the policy-impact analysis model: monitoring, forecasting, goal setting, and policy analysis and implementation. Monitoring refers to the identification and selection of issues of concern to policy

makers. The second stage of the model, forecasting, involves using a variety of futures research techniques to forecast probable futures and their relationship to selected issues. In response to the projected trends and probable futures, policy makers then establish goals, the third stage of the model.

In the fourth stage a variety of possible policies are analyzed in order to determine their probable impact, and are ranked on those characteristics deemed important, e.g., relative costs versus benefits. Those policies ranked at the top are then implemented. Evaluation occurs when the stages of the model are repeated using additional analyses and further refinements. This model will be described and illustrated in more detail below.

Stage I: Monitoring

Monitoring consists of first, in conjunction with policy makers, identifying areas for study; selecting appropriate indicators of those issues of concern; and developing a database that includes those indicators. There are constraints in this process. Primary among these is the availability of historical data that is reliable and valid. This point need not be belabored. Several writers in the field have dealt thoroughly with criterion for developing and assessing reliable and valid historical data, among them Halstead (1974) and Adams, Hankins and Schroeder (1978). As well, the monitoring stage does not proceed in a linear fashion through issue identification, indicator selection and database development. Issues often arise through a perceived need within the state. Available data is used to generate some indicator of need or of a situation that must be changed. At this point events usually proceed in some linear fashion through indicator selection and the acquisition or development of a database.

The development of an effective system of indicators for use in educational policy development dictates adhering to several additional principles. First, indicators should be policy relevant. The primary focus of a database of educational indicators for use in policy analysis should be on choices policy makers must deal with. Much research concerns relationships that are not within the control of policy makers, and indicators of such relationships are relevant to policy making only as they establish the "givens" of the situations, the constraints in which policy alternatives actually exist.

Second, indicators must be intelligible to policy makers. Indicators must be useful to decision makers who often spend large amounts of time reviewing many, perhaps contradictory, measures of conditions. Even though they may be derived from an extensive and complex archive of data that does include many measures, the indicators reported should be few in number and expressed with a minimum of jargon.

Third, wherever possible, indicators should be derived from existing data sources. There are three reasons for this. First, such a procedure is cost effective. Data gathering is expensive. Second, novel data sources will introduce errors until new procedures are standardized and widely understood by those supplying the data. Third, if indicators can be defined or derived from existing data collections, it is possible to measure past events using straight-line extrapolation, as well as more complex time-series and trend fitting strategies.

Fourth, wherever possible, indicators should be located within connected models of educational events. Some indicators in a single perspective are useful as observations simply because they warn us something is going on. Wherever possible, indicators should be developed within models of interconnected events. For example, industrial growth creates population migration which generates enrollment while changing enrollment patterns and, perhaps, changing educational needs. Each of the underlined words marks a possible causal relationship within the model. Attempting to measure the critical interconnections of the social system that effect educational events, so that future demands and future needs can be predicted, is an ambitious and necessary goal.

Fifth, wherever possible, indicators should be sensitive to the possibility of unexpected changes in the system. Having expressed the need for model building in the fourth principle, the need for model breaking, or at least model reevaluation, must be considered. The most serious shortcoming of most policy indicator systems has been their static nature. Failing to allow for shifts in relationships within models has contributed to the belief that policy indicators are unrelated to reality and have little value in long-range planning.

All policy development requires information of some sort, whether or not the information is supplied formally. Some decisions require only a small amount of information, and some require a great deal. To understand why there is a difference, it is necessary to realize that, at the most general level, the purpose of information is to reduce uncertainty. As uncertainty increases, the need for information also increases. More complex situations inherently involve more uncertainty, as do more unstable environments.

Information is also needed to facilitate the process of negotiation by helping the interested parties assess more rapidly and accurately which among the possible propositions that are advanced stand some chance of being accepted. In other words, information is needed not only on social, economic and technical trends, but also on value systems (Eckstein, 1974). This leads, inexorably, to the second stage of our model, that of forecasting.

Stage II: Forecasting

Forecasting is intrinsically tied to policy development. As Peter Drucker noted, "all our knowledge is about the past; all our decisions about the future." Yet of the information available to policy makers, forecasts are the most suspect because they depart from what is knowable. We may, at some point in the future, find that we chose correctly from previous patterns and extant relationships in developing a forecast. But that knowledge is, to most of us, as yet unattainable. It is this problematic nature of forecasting that is faced by policy makers. Given that various different forecasts of the same trend or value are available, Ascher (1975) characterizes the burden of the policy maker as greater than the original task of forecasting. He suggests that the policy maker attends to those forecasts that appear reasonable and so tacitly choose assumptions and methods for forecasting.

A number of forecasting techniques have been developed over the last few decades and can be separated into the two general classes of quantitative techniques and qualitative techniques. Quantitative techniques include those

techniques that are based on the mechanical manipulation of historical data. Among the more widely used quantitative techniques are regression analysis, exponential smoothing and decomposition methods.

Basically, quantitative techniques for forecasting embody the procedures and properties of one or both of two models. The time-series model, a model which assumes that a pattern recurs overtime, is perhaps the most common. Time-series techniques allow discerning a pattern and its time period. A starting point can then be chosen with this model and a value forecast for some point in the future. This model explicitly assumes that a pattern can be identified on the basis of historical data and does not account for present actions.

A second model, the causal or explanatory model, assumes that variables other than time are important in forecasting. These techniques require data on several variables in addition to the variable being forecast. They allow developing a number of different forecasts given the relationships postulated. Causal models generally take longer to develop and are more sensitive to change in underlying relationships than time-series models.

Qualitative forecasting techniques are used to forecast changes in a basic pattern as well as the pattern itself (Wheelwright and Makridakis, 1980). These techniques are most often used in cases where historical data that directly represent the variable to be forecast is not available. Among the qualitative techniques currently used are: (1) the exploratory use of curve fitting techniques, or curve fitting with minimal data and subjective review of the extrapolated curve; (2) morphological analysis, or a systematic manner of enumerating all combinations of possibilities for the variables and situations being forecast (Zuicky, 1967); (3) delphi and cross-impact approaches that use expert opinion to gauge the subjective probability of an event's occurrence and the magnitude of its effect; and (4) the purely normative approach of decision tree construction using the ideas of decision theory to sketch out the objectives and sub-objectives a panel of experts see as necessary to attain a chosen goal or future.

Given the wide range of forecasting techniques, it is important that the most appropriate technique or combination of techniques be applied to a given situation. Wheelwright and Makridakis (1980) list six properties of forecasting techniques that must be considered in preparing a forecast. First, the underlying pattern of the data must be recognized. Using quantitative techniques, explicit assumptions are made about the underlying pattern of the data while qualitative techniques allow patterns to take virtually any form and rarely require that these be identified explicitly. Second, the accuracy of the method must be assessed. The accuracy of a technique in predicting patterns and relationships similar to those in historical data is one form of accuracy. Another is the success of a method in predicting when the pattern changes and past error calculations are inappropriate. Third, the appropriate model or models to be used in preparing a forecast (i.e., causal or time-series) must be identified. Fourth, the costs of a forecasting technique must be carefully considered. Development costs, the cost of acquiring and storing data, and analysis cost, must all be estimated. Fifth, the time period for which a forecast is being prepared should be delineated, some techniques are appropriate for short-term forecasts whereas others are more appropriate for longer term forecasts. The sixth, and last consideration is the applicability

of the chosen method to a given set- ting. In general terms, are the hardware and software, expertise, and under- standing of the techniques accessible?

In the goal setting stage, it is useful to categorize forecasting techniques not only as quantitative and qualitative, but also as exploratory and normative (Holroyd, 1978; Lanford, 1972). Exploratory forecasting in this framework consists of analyzing trends and cycles to determine what might happen. Normative forecasting can be seen as defining a desirable future and the obstacles to its achievement, and so determine what should happen. At this point there can be no illusion that we have left the knowable. The goal setting stage requires: (1) that we attempt to determine the social milieu within which education will function in the future and (2) that we determine the role of education in that milieu. In Stage IV, policy analysis and implementation, actions within each year's predicted, but as yet unknown, environment must be plotted which can lead to that role. Goal setting begins with exploratory forecasts and moves into the use of normative forecasts. Policy analysis and implementation employ purely normative forecasts as appropriate policies are decided.

In developing policy-useful exploratory forecasts, the interrelatedness of various trends become crucial to forecast accuracy. The examination of forecast methodologies has demonstrated that no forecasting task stands alone from all others (Ascher, 1978). For example, demographic forecasts are based on economic, technological and social assumptions. Determining the component trends that provide the background to a forecast and the potential magnitude of error for each component are relatively straightforward but essential tasks. As well, one must also be concerned with chosing the individual forecasts that will be blended into an overall environmental forecast. The American Association of State Colleges and Universities recently developed an excellent guide to assist institutions in long-rang planning (1978) that should be attended to by those concerned with policy development at the state education agency level. An example using forecast areas that may be of particular concern to long-range planning for education, developed by John Osman, was included in this planning guide. These areas of concern contributing to the overall environmental forecast included forecasts of: population, governance structures; international affairs; the physical environment; energy use and supply; the economy; advances in science and technology; trends in human settlements; trends in the world of work; lifestyle changes; and patternds of participation in private and public enterprise. The trends that are emphasized in an overall environmental forecast might differ between states. For example, the urbanization trend in human settlements may be a driving force in one state and not in another. Within each state's government and system of higher education is a vast store of expertise and a state embarking on a policy-impact analysis approach would be expected to develop thorough exploratory forecasts for the state and its subregions.

Stage III: Goal Setting

The first two stages of a policy-impact analysis model, monitoring and forecasting, perform the role of organizing, structuring, and articulating images of the future with respect to a particular set of assumptions and indicators. The next stage of the model, goal setting, revolves around the process of setting realistic goals given the information provided in the first two stages of the model. This stage requires the generation of a desirable

future, or futures, in a procedure much like that of forecasting using the delphi method. This process may involve actors from all the power loci concerned with the future of education in a state. The groups involved might include representatives from parent and teacher groups, local education agencies, legislature, Governor's Office, Office of the Chief State School Officer, as well as authorities from business, industry, and public interest groups. The rationale for this stage is based upon the importance of having a concept of a desirable future with respect to a particular issue in order to develop policies. A desirable future in this case can be defined as one in which education maintains a meaningful and accepted role within the social system. This does not mean, necessarily, the role it has today. The central characteristic of education in this country has been change. This characteristic, we can be relatively sure, will not change.

The approach up to this point has been straightforward. As we approach goal setting and then normative forecasting, however, the model becomes more fluid. Ascher (1978) characterizes normative forecasting techniques as decision making procedures in that projections are developed to assist in achieving a given set of goals, or to define what set of goals can be achieved. In a corporate setting this would be the domain of top-level management supported by a strategic planning officer or team of consultants. Embodied in the policy-impact analysis approach is the assumption that a number of formal and informal power loci within a state set the goals of education and determine what actions will be taken in attempting to reach those goals. The key to this particular process is the inclusion of participants from all the concerned power loci in the identification of likely events and in reviewing results. In this way it is hoped a more cooperative approach to educational planning and budgeting can result. It is also assumed here that the coming decade will be one of increased competition for available funds. This process assumes that those sectors which occupy a clear and necessary niche within the state and present their case for a share of the available funds in a unified and persuasive manner, will receive funds. In the coming decade momentum alone will not assure that an agency or institution receives its share. Put more bluntly, if the various members of the educational community enter the legislative arena "at odds," they can be assured of living in a state with an excellent system of roads and a well financed system for social services.

In this stage of the model, then, an exploratory forecasting process using quantitative forecasting techniques and some qualitative assessments of possible impact events would be used to develop a view of one or several possible future environments. Taking each of these integrated sets of events and conditions and developing a story or "scenario" around them has proven a successful aid in grasping what a possible future might be like. Providing policy makers with exploratory forecasts and involving them in the generation of future scenarios has also proven successful in developing their awareness of future conditions (Masterton, 1981).

With an awareness of each probable future environment, realistic goals can be outlined for each set of possible conditions. It would be expected, under this model, that the disaffection within the various power loci would be minimized when environmental constraints are recognized. It would be hoped that the most creative and service maximizing configurations would also be the result of recognizing environmental constraints. At this point a normative forecasting process would be used involving qualitative forecasting techniques

such as the delphi, morphological methods, cross-impact and trend-impact analysis and decision tree analysis.

Stage IV: Policy Analysis and Implementation

The first three stages of this model serve to identify specific trends, the events which may affect those trends, and the goals of the organization. As such, these steps specify policy options and responses. In the final stage estimates are made on how a particular policy may impact a given trend through influencing the probability of the occurrence of one or more specified events affecting the trend. As may be noted in Figure 1, there are three ways policies may affect trends: directly, directly and through events, and through events only.

Insert Figure 1 about here

The initial task in this stage, then, is to identify those events which may have positive or negative effects on those trends or state of affairs related to organizational goals. For example, if an event adversely affects an existing trend which was beneficial to the organization, then policies which would make the event less likely to occur, or which would delay or mitigate the effects of the event, should be developed. Conversely, if an event has the effect of enhancing a given state of affairs, or a trend consonant with organizational objectives, policies should be developed which would increase the probability of the event occurring, and its impact. The probable relationships of policies and events may be tracked in a policy-to-events impact matrix, a matrix which enables the staff to generate new estimates of the probabilities and impacts of events modified by the policies. These estimates can be calculated on the basis of multiple conditional probabilities using Monte Carlo techniques. Most cross-impact analysis packages follow this strategy.

The effect on trends of events that would not be expected with a purely extrapolative forecast can, at this point, be estimated using probabilistic forecasting techniques such as trend-impact analysis. In this normative forecasting strategy a trend is extrapolated and then, in a delphi or cross-impact like process, the likely occurrence of an event that would impact on that trend is generated. An estimate of when that event might occur and its probable impact are also generated and the trend line modified with these estimates. The result is an impacted or "surprise free" forecast.

The end result of this somewhat complex activity is a policy-impacted forecast for a particular trend given the implementation of specific policies designed to affect that trend directly, or indirectly by impacting on events which effect the trend. The policy-impacted forecast then, not only incorporates those features of probabilistic forecasts, but also includes estimates of the impact of policies on events effecting the trend.

When the selected policies are implemented, the process of monitoring begins anew, enabling the evaluation of the effectiveness of the policies by

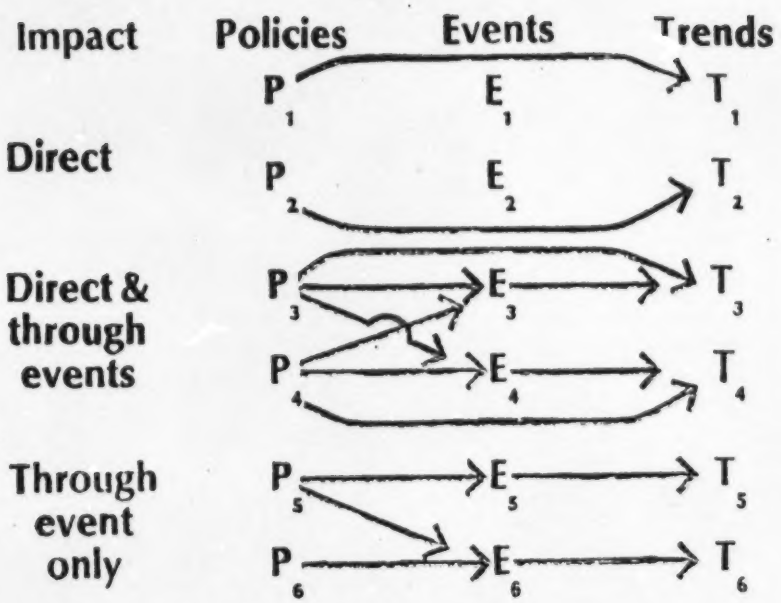


Figure 1. Three Ways Policies Impact Trends

comparing actual impacts with those forecasted. This requires that a database of social/educational indicators be updated and maintained in order to evaluate the forecasts and policies and to add new trends as they are identified as being important. Implemention of this model also requires that current and past events be reevaluated, and that probabilistic forecasts be updated in order to enable goals to be refined and reevaluated. In essence, this process allows the higher education community a maximum hand in defining its place within the evolving social environment.

To those familiar with long-range planning techniques the policy-impact analysis model offers nothing new or startling. Instead, it ties together current forecasting and planning techniques and provides a model for their systematic use in the policy making process. In fact, similar models have been postulated. What may be unique is the assertion that the policy-impact analysis model should be put into place and used, now, for state level planning and budgeting in higher education. Moreover, we believe that the data, software, and even focus for implementing this model are present in most states. In the next section an example of how this model might be implemented will be presented.

Louisiana: A State Level Example

Policy-Impact analysis is a future oriented process which aids planners in identifying, analyzing and evaluating the policy options available to them. This model seems appropriate as a tool for helping state educational planners provide assistance to local school districts, particularly in areas where unexpected demographic or socioeconomic trends occur.

For example, currently there is extensive lignite coal resource development in the northwest region of Louisiana (including Bienville, De Soto, Natchitoches, Red River and Sabine Parishes). School facilities planning in this area of the state for the next ten to fifteen years requires a coordinated effort using the most current forecasting techniques available in conjunction with a logical goal setting and implementing procedure. Since the policy-impact analysis model entails both historical trend/forecasting techniques and goal setting-policy implementing procedures, it may be usefully applied to this problem.

The Louisiana State Department of Education (LSDE) has been contacted by local school boards and state legislators from this region for technical assistance in enrollment projections and facilities planning. The role of the state educational planner in Louisiana is a sensitive one, since the current Louisiana Constitution (written in 1974) delimits the state's role in local school business matters. Prior to 1974, the Bureau of School and College Plants in the LSDE aided the local school boards in inventoring existing school facilities and planning future facilities. Bulletin 711, produced periodically by this bureau, provided guidelines and directions for architects, builders, contractors, engineers, administrators and other involved in facility planning.

This bureau was eliminated in 1974, however, and its function as a state facilitator for local school construction has not been delegated to any other bureau within the LSDE. When approached by local school boards and state legislators for technical assistance, the state education planner must be

careful not to overstep the constitutional limits placed on the LDSE with regard to local school business operations. Referring to the policy-impact analysis model, it appears that: (1) the state education planner can do the monitoring and forecasting for the local school board; and (2) the state education planner can aid the local school board in goal setting and policy implementation by coordinating local efforts with regional and state activities. This coordinating role with regard to goal setting and policy implementation would be particularly important in an area such as the northwest region of Louisiana, where the needs of five parishes must be taken into consideration.

In the following sections, the role of the state education planner as the doer of the monitoring and forecasting stages and as the facilitator for the goal setting and policy implementation stages will be delineated using the northwest Louisiana example. It should be noted at the outset that this project is in the planning stages, and that none of the proposed activities by the LSDE has been accomplished. It is hoped that working through the application of the policy-impact analysis model to this problem area in advance will aid the LSDE if the project is undertaken.

Stage I: Monitoring in Northwest Louisiana

The three components of monitoring are: (1) the identification of the area of study; (2) the selection of appropriate indicators (or variables) for study; and (3) developing and plotting the historical data. For the state education planner in Louisiana, the identification of an appropriate area of study could come from several sources: (1) requests from the state Superintendent of Education; (2) requests from the Board of Elementary and Secondary Education; (3) requests from local school boards; (4) requests from state legislators; and (5) personal identification of an area of study by the planner.

In the case of the northwest Louisiana project, requests for technical assistance were received from local school boards and from state legislators. These requests reflect growing concern about orderly growth and development in the lignite impacted area. During 1979, ten corporations requested permits from the State of Louisiana for the exploration, mining, and use of lignite in the area. It is estimated that over one billion tons of recoverable lignite exists in Louisiana, comprising 17.4 percent of the state's known energy resources. (Louisiana State Department of Natural Resources, 1980).

In 1979, Governor Edwin Edwards designated the previously mentioned parishes as an Energy Impacted Area pursuant to Section 601 of the Powerplant and Industrial Fuel Use Act of 1978 (PL 95-620). A proposal by Senator Don Kelly of Natchitoches Parish during the 1981 Louisiana Legislative Session to earmark 20 percent of the state's Enhanced Mineral Income Trust Fund for development of government facilities in the area was defeated, but debate over the proposal focused more attention on the needs of the area. One result of this debate was the realization that more detailed information was needed on the real impact that lignite coal development would have on governmental services in the area.

Once an area of study has been identified, the next step is to select appropriate variables for study. The sequence of events that might lead to an

increased need for school facilities in the region is as follows: industrial growth produces an increase in population, which leads to an increase in school enrollment, which may necessitate increased school facilities.

Variables of interest may be broken down into the following broad categories: (1) indices of industrial growth, particularly employment data; (2) population data on a ten year annual basis for the municipalities and parishes in the region, broken down by age groups; (3) school enrollment data by parish for the past ten years; (4) current number of students and classroom teachers for all schools in the five parishes; (5) current number of schools and size of sites plus number of classrooms and conditions of building, (6) current information on school transportation systems in the parishes, including number of buses and number of students transported annually; and (7) plans for expansion by local school boards plus information about indebtedness and fiscal condition of the school district.

Once the variables have been selected, the next stage in monitoring is to develop the database. This involves locating the appropriate sources for the data and determining the number of years of data that one needs. Renfro (1980) proposed that the planner have as many years of historical data as the time horizon of the study. Since the impact of the lignite coal resource development will be felt most severely in the next ten years, ten years of historical data will be required for most of the variables. Data more than ten years old will have marginal utility for the study.

Sources of data for the industrial indices include: (1) the federal Economic Development Agency (EDA) for the region; (2) the Louisiana Association of Business and Industry; and (3) annual business data for the region compiled by Dr. James R. Michael of the Louisiana Tech University College of Administration and Business. Additional information on the industries that have applied for permits for lignite exploration may be obtained through the Department of Natural Resources Geological Survey team. This information was gathered as part of federal reporting requirements for Section 601 of the Powerplant and Industrial Fuel Use Act of 1978 mentioned above. These data include estimates of the number of construction, operations and secondary employees currently in the area plus projections of the number of employees that will enter the area over the next fifteen years.

Population data from the 1980 United States Census is available through the Louisiana State Planning Office. Annual estimates of the population for each year from 1970 to 1982 are available on the parish and municipality level from Louisiana Tech University. These estimates will provide the most accurate picture of annual population growth in the region for the past ten to fifteen years.

Enrollment data by parish are available through the Bureau of Research at the LSDE for the past fifteen years. The data for the past three years are available on computer tape; the data for previous years could be easily computerized. The current number of students and classroom teachers for all schools in the five parishes will be available through Principal Summary Session Reports, sent annually to the Bureau of Research. Information on the number of classrooms and condition of buildings is available through Part II-A of the Annual Financial and Statistical Report. This part of the annual report has been expanded for the 1981-82 school year, such that data for that

year will be the most thorough data ever collected by the LSDE.

Information on school transportation systems is also collected as part of the Bureau of Research's Annual Report process. Plans for expansion of existing facilities can be obtained by a special survey of the school board in each parish. Extensive information about indebtedness and the fiscal condition of the school district is available through Part II-A of the Annual Report. Four years of this data is on computer tape; the variables of interest could be easily computerized for previous years.

Thus, the information required for the monitoring stage of the project can be easily obtained and entered into a computerized database. The state education planner can collect and organize this data on a regional basis for the local school boards and state legislators more thoroughly and accurately than they could themselves. This database will then be extensively used in the second stage of the policy-impact analysis model, forecasting.

Stage II: Forecasting for Northwest Louisiana

As noted above, it is possible to categorize forecasting techniques as exploratory or normative. Exploratory techniques are used in stage two to analyze trends and cycles to determine the most likely future developments. Normative techniques are used in stage three (goal setting) to define the most desirable future developments and a course of action that should lead to them. In the northwest Louisiana example, the purpose of the forecasting stage is to make the most accurate projections of school enrollment for each of the five parishes over a ten year period (1982-92, for instance). These enrollment projections would then be used in the goal setting stage to help define the most desirable future for each of the five parishes with regard to additional school facilities development.

Both quantitative and qualitative techniques will be used in stage two to define the expected future most accurately. Quantitative techniques employ mathematical models to predict the future, while qualitative techniques use judgments by experts to predict that future. Various quantitative mathematical models, each with a different set of assumptions, may be used to project enrollment figures. It will be necessary to check these projections, however, against expert opinion before proceeding to the goal setting stage. It may be that the assumptions of the underlying mathematical models do not conform to the realities that exist in each of the parishes. For example, a mathematical model using a linear projection technique may be appropriate for Nathcitoches Parish, but inappropriate for Red River Parish, where extensive construction operations will have an immediate impact on school enrollment that radically alters the linear pattern. Expert opinion on the occurrence and impact of extraordinary events can be used to alter the mechanical projections made by the quantitative techniques.

The quantitative techniques that may be used to project school enrollments in northwest Louisiana will be discussed first. As noted above, these quantitative techniques may be either pattern based models (time-series models) or causal models. Pattern based models vary in complexity from simple averaging and ratio methods to cohort survival, Markov-chain, and various curve fitting formulas. Causal models develop projections on the basis of the numerical values of indicator variables which have been demonstrated through

multiple regression to have a strong relationship to enrollment levels. In the northwest Louisiana example, these indicators variables would most probably be measures of industrial growth that is attributable to lignite coal resource development in the area. Unfortunately, indicators of industrial growth associated with this lignite development are very tentative at this time, primarily because no coal will be mined until 1984. Some indicators of industrial growth have risen in the area, but preliminary examination of the relationship between these indicators and enrollment levels indicate that the relationship is not strong enough at this time to warrant the development of complex causal models.

Instead, it seems more appropriate to examine pattern based models as they are presently being employed in Louisiana to project school enrollments and to determine how these models may be improved. The Board of Regents and the Louisiana State University Division of Institutional Research currently use cohort survival techniques to project elementary and secondary enrollments, which then are used to project numbers of freshmen entering colleges and universities in the state. This method is adequate for projecting the size of incoming freshmen classes, but does not accurately project elementary and secondary enrollments, particularly in areas where extensive in- or out-migration occurs. For example, previous projections of school enrollment by the Board of Regents in some of the parishes in the lignite-impacted area have indicated enrollment decreases, whereas enrollment has actually increased.

An alternative model has been developed by the Department of Natural Resources (DNR). This model projects the number of new students entering the area directly as a result of construction, operation, and support services for the coal mines. Under Section 601 reporting requirements, DNR gathered aggregate estimates of the number of employees that will be needed by the mines in either construction, operation, or support capacities. DNR then calculated how many of these employees would migrate into the area during a three year period (1918-83). Estimates of the age distribution of children for the in-migrating workers with families present were then made. These calculations allowed DNR to estimate the in-migrating school-aged population for this three year period. Unfortunately, these predictions have not proven to be very accurate, primarily because of delays in the schedules for construction and operation of the mines.

To summarize, then, the cohort survival technique is inadequate because it does not allow for the effect of in-migrating, while the DNR technique has failed thus far because of faulty industrial estimates of the number of in-migrating workers. Several alternative pattern based techniques are available to the state education planner. The planner must choose from among these techniques the one most appropriate for each parish. At present, the most attractive alternative may be double exponential smoothing (Gardner, 1980). This time-series technique allows one to selectively weight historical data points on the basis of the assumed relative importance of more recent information. For example, the enrollment figures in Red River Parish could be collected for the last twelve years (since 1970). A formula could then be derived to predict enrollment for the next three years based on the twelve-year trend with heavier weights given to the enrollment figures for the last years of the historical data. As more in-migrating students enter schools and elevate recent enrollment figures, projections for the future will increase at a greater rate using this technique.

Once the quantitative model for forecasting enrollment has been used to project enrollment for a given period of time, the projections should be checked against qualitative forecasts generated by experts from each parish. The delphi technique could be used to develop a combined forecast of enrollment for each parish based on the opinions of a group of experts within those parishes. Thus, the double exponential smoothing technique could be utilized for each parish and then separately checked for each parish using the delphi technique. If there are discrepancies between the quantitative of qualitative estimates, then a set of enrollment projections (high, medium, low) complete with alternative assumptions could be developed for the policy makers to utilize when setting their goals.

Stage III: Goal Setting for Northwest Louisiana

In the goal setting stage of the policy-impact analysis model, likely futures derived from exploratory forecasting are converted into desirable futures through normative forecasting. For example, let us suppose that the state education planner forecast an increase of 500 students in De Soto Parish for the 1982-84 period and also knew that the current school facilities in De Soto were at maximum capacity. The likely future is that the schools would be severely overcrowded by 1984; the desirable future might be that a new K-12 school be constructed by 1984. If this were the desirable future, the specific goals could be set up for the following two years to accomplish the desired future by 1984.

Normative forecasting techniques are, by necessity, decision making procedures. The decision to construct a new school must be made by the local school board and superintendent with input from other power loci such as state representatives and local business leaders. It is at this point that the sensitive nature of the state education planner's role in policy-impact analysis becomes apparent.

In the monitoring and forecasting stages, the state education planner organized data and developed likely forecasts to meet the information request of the local school boards and legislators. As noted above, the planner is the doer during these stages. When goal setting and policy analysis/implementation begin, however, the planner must assume the role of facilitator. The state education planner provides likely futures based on quantitative/qualitative methods, but it is the local policy makers who must define the desirable future and the goals to meet that future.

In the northwest Louisiana example, the state education planner would first report back to those school boards and legislators who had requested information. The planner would present to each parish the likely future for that parish and for other parishes in the region. During these separate meetings, the local school boards may see the need for a coordinated approach among the parishes to education planning and budgeting. They may ask the planner to coordinate a meeting of the various power loci, including members of the school board from each parish, the school superintendents from each parish and local state legislators. It is incumbent upon the local school boards to request the state education planner to assume this facilitating role; the planner should not assume the role without the request of the locals.

In the first meeting of these local school representatives, the state

education planner should provide matrices of likely futures for the region. One such matrix might have parish on one dimension and high/low enrollment projections on the other dimension. This matrix would thus have ten cells, which could be collapsed into five high enrollment futures or five low enrollment futures, which could be further collapsed into one high enrollment or one low enrollment future for the region as a whole. Of course this matrix would be accompanied by other relevant quantitative/qualitative information such as current condition of buildings, current maximum capacity of buildings, school transportation patterns, plan for expansion, and fiscal conditions of the school districts.

The state education planner would, therefore, provide the policy makers with exploratory forecast and aid them in the generation of future scenarios. The representatives from each parish would, of course, come into the meeting with some general idea of a desirable future for their parish. These desirable futures could be combined and restated using delphi procedures. For example, the parishes may generate a desirable future that includes the earmarking of ten percent of the state's Enhanced Mineral Income Trust Fund for school construction in the region. Planning for the most efficient and timely use of the funds could be accomplished by considering each parish's desirable future and compromising on a future most desirable for the region. According to Renfro (1980), this process of normative forecasting will involve a great deal of discussion, debate, and several rounds of forecasting in a delphi-like process. During this process, the state planner will serve at the pleasure of the local representatives. The planner may be asked to further facilitate the discussion or may be asked to leave the discussion as the policy decisions are being made.

Stage IV: Policy Analysis and Implementation

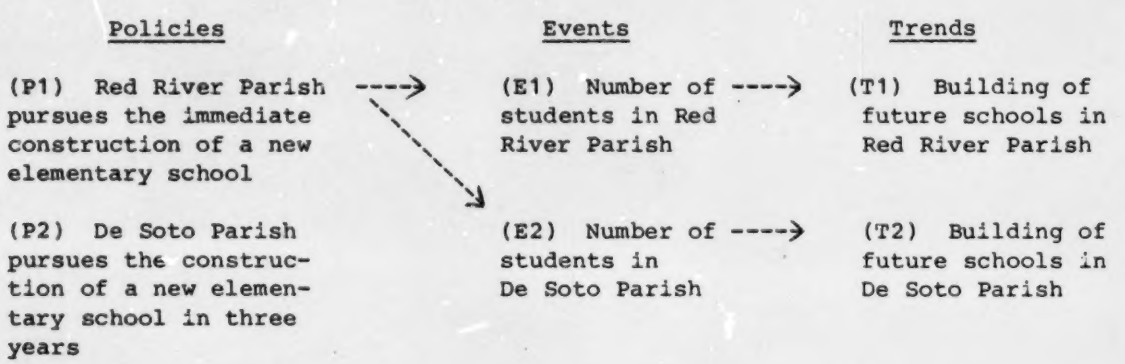
According to Renfro (1980), the fourth stage seeks to determine those policy options and responses which are available to decision-makers to turn the likely future (stage 2) into the desirable future (stage 3). The initial task in this stage is to identify those events which could have positive or negative effects on those trends related to the goals set. Once these positive or negative events have been identified, policies which will bring about the positive events or decrease the probability of the negative events should be implemented.

Again, the role of the state education planner in this stage is a senitive one. The planner is not a policy maker, yet the local school boards or legislators may continue to seek technical assistance from the planner. The major contribution that the planner can make at this point is to aid the policy makers in assessing the impact that potential policies may have on events that will affect trends.

The planner should take each potential policy and set up a policy-to-event impact matrix. This procedure may become very complex, but it is absolutely necessary for the policy-impact analysis model to work. A simple example may make this part of the model easier to understand.

Assume that only two parishes (Red River and De Soto) were involved in lignite coal resource development. Further assume that the two local school boards and superintendents met and established two policy options: (1) Red

River Parish will pursue the immediate construction of a new elementary school in the western part of the parish across the Red River from De Soto Parish; (2) De Soto Parish will pursue the construction of a new elementary school in three years in the eastern part of the parish across the Red River from Red River Parish. What impact could these policies have on events that might effect trends? Note the figure below:


Policies
Events
Trends
(P1) Red River Parish pursues the immediate construction of a new elementary school
(E1) Number of students in Red River Parish
(T1) Building of future schools in Red River Parish
(P2) De Soto Parish pursues the construction of a new elementary school in three years
(E2) Number of students in De Soto Parish
(T2) Building of future schools in De Soto Parish

This figure plots only the effect of P1 on E1, T1, E2, and T2. The immediate construction of a new elementary school in Red River Parish might influence construction and operation workers with families to move to Red River Parish rather than De Soto Parish, which only has plans for a new elementary school. This would have the effect of increasing the number of school children migrating into Red River Parish and decreasing the number of school children migrating into De Soto Parish. These events may in turn stimulate a greater demand for more school construction in Red River Parish and may severely depress the demand for more school construction in De Soto Parish. Thus a cooperative effort by two parishes involving slightly different timelines for school construction might result in competitive situation between the two school systems for new in-migrating students.

If the state education planner is involved in the policy analysis/implementation stage, the planner must create realistic policy-event-trend matrices and then aid the local school boards in evaluation of new and old policies. Again, the planner must be careful not to overstep his/her role as advisor. The planner's role must be confined to helping the locals create the most realistic policy-event-trend matrices using delphi and cross-impact analysis. This final stage leads back to the monitoring stage, for which the planner has a primary responsibility. The policy-impact analysis model is a cyclical one hopefully involving increasingly refined exploratory and normative forecasting.

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